



Standard Deviation in Real-World Contexts

These materials, when encountered before Algebra 1, Lesson 13: More Standard Deviation, support success in that lesson.

Goals

- Apply standard deviations to real-world contexts.

Lesson Narrative

The mathematical purpose of this lesson is for students to practice calculating and applying the standard deviation in real-world contexts. Previously, students learned how to calculate the standard deviation and discovered its value in decision-making. In the associated Algebra 1 lesson, students apply their understanding of standard deviation to real-world contexts. The third activity in this lesson allows students to characterize the best route as one that is not only faster than the other, but more or less consistent, predictable, and efficient than the other. Students reason abstractly and quantitatively (MP2) when they use appropriate statistics for a situation to decide a better option.

Standards

Addressing 5.NF.A.2, HSS-ID.A, HSS-ID.A.2
Building Toward HSS-ID.A.2

Instructional Routines

- MLR5: Co-Craft Questions

Required Materials

Materials to Gather

- Statistical technology: Activity 2

Student Facing Learning Goals

Let's think about standard deviation in the real world.

13.1

Marathon Runner

Warm-up

5 min

Activity Narrative

The purpose of this activity is for students to start thinking about what they need to know when facing problems with unusual units of measurement. Students are faced with the situation that a person is running a marathon and, from the picture, can see that the person is currently on mile 6. Students will approach this situation with different knowledge about and experience with marathons, which will impact the questions they craft.



Access for English Language Learners

- This activity uses the *Co-Craft Questions* math language routine to advance reading and writing as students make sense of a context and practice generating mathematical questions. Keep the questions students craft as a reference when students see a similar situation in a later lesson.

Standards

Addressing 5.NF.A.2

Instructional Routines

- MLR5: Co-Craft Questions

Launch

Tell students to close their books or devices (or to keep them closed). Arrange students in groups of 2. Introduce the context by displaying the image for all to see. Use *Co-Craft Questions* to orient students to the context and elicit possible mathematical questions.

Give students 1–2 minutes to write a list of mathematical questions that could be asked about the situation before comparing questions with a partner.

Student Task Statement



The runner is running a marathon.

Student Response

Sample responses:

- How long is a marathon?
- How long has the runner been running?
- Does the runner continue at the same speed?
- How long do most people take to finish a marathon?
- How long will the runner take to finish the marathon?

Activity Synthesis

The goal of this discussion is for students to consider more mathematical questions about the situation. Invite several partners to share one question with the class, and record responses. Ask the class to make comparisons among the shared questions and their own. Ask, “What do these questions have in common? How are they different?” Listen for and amplify language related to the learning goal, such as adding context to the situation. Since students will see a similar prompt in a future estimation *Warm-up*, focus the discussion on questions students can ask to gain the information they need to interpret the context.

Activity Narrative

The goal of this activity is for students to learn how to calculate standard deviation (σ or σ_x) using technology. Standard deviation is a measure of variability. The work in this activity prepares students to be successful in a future Algebra 1 lesson when they have to calculate the standard deviation of data sets.

Standards

Addressing HSS-ID.A
Building Toward HSS-ID.A.2

Launch

Statistical technology is needed for every student. Allow students to work individually. If technology is limited, students can work in pairs. Demonstrate how to use the technology available in your classroom to compute the standard deviation of a data set. For the purposes of exploration, use the population standard deviation, often denoted σ or σ_x .

Ask students if they like any movies with low ratings or dislike any movies with high ratings. Discuss how movie ratings do not always match how a person will feel about the movie. Then ask if the same is true for restaurant ratings.

Student Task Statement



Movie A ratings on a 10-point scale:

9, 8, 10, 10, 7, 1, 8, 1, 2, 8

Movie B ratings on a 10-point scale:

9, 8, 8, 7, 9, 7, 7, 9, 7, 8

Restaurant A ratings on a 100-point scale:

88, 87, 89, 90, 87, 85, 88, 91, 86, 86, 88, 89

Restaurant B ratings on a 100-point scale:

90, 65, 89, 50, 94, 93, 95, 95, 75, 70, 88, 89

1. Calculate the mean and standard deviation for each data set.
2. Considering these statistics, which movie and restaurant would you choose? Explain your reasoning.

Student Response

1.
 - Movie A mean: 6.4, standard deviation: 3.44
 - Movie B mean: 7.9, standard deviation: 0.83
 - Restaurant A mean: 87.83, standard deviation: 1.68
 - Restaurant B mean: 82.75, standard deviation: 13.85
2. Sample response: I would choose Movie A, because the large standard deviation means viewers probably either love or hate this movie. I tend to give movies the benefit of the doubt, so I would probably love this movie. I would also choose Restaurant A because the mean is greater and the ratings are less variable. I don't really want to risk a

low-rated place when I eat, so I chose the restaurant that has more consistent ratings.

Activity Synthesis

The purpose of this discussion is to clarify how to calculate standard deviation using technology and how to interpret the standard deviation in these situations. Select students to share their solutions. Ask students how the standard deviation influenced their preferred movie and restaurants.

13.3

Which Route Is the Best Route?

🕒 15 min

Activity Narrative

The goal of this activity is for students to practice the skill of comparing data sets by comparing standard deviations. Previously, students discovered the importance of variability in comparing data sets when they chose the better choice first, then calculated the standard deviation and reflected on whether or not variability was a factor in their decisions. This activity gives students the opportunity to calculate the standard deviation and use it to inform their decisions first. Students reason abstractly and quantitatively (MP2) when they use appropriate statistics for a situation to decide a better option.

Standards

Addressing HSS-ID.A.2

Launch

Arrange students in groups of 2. Tell students there are many possible answers for the questions. Demonstrate how to use technology to compute the standard deviation for each route. After quiet work time, ask students to compare their responses to their partner's and decide if they are both correct, even if they are different. Follow with a whole-class discussion.

Access for Students with Disabilities

- Representation: Access for Perception. Read the statement aloud. Students who both listen to and read the information will benefit from extra processing time.
- Supports accessibility for: Language, Attention

Student Task Statement

Priya times the ride from home to school on two different routes.
Here are the times in minutes:

Route A: 21.5, 23, 24, 25, 26.5

Route B: 12, 20, 24, 28, 36

- Before calculating the standard deviation, predict which route has a greater standard deviation. Explain your reasoning.
- Calculate the standard deviation, and use it to decide which route you would recommend for Priya.



Student Response

1. Sample response: I predict the standard deviation for Route B will be greater, since the times for Route A are all near 24 minutes, but the times for Route B can be much faster or slower. Since the times for Route B are more variable, it probably has a greater standard deviation.

2. Route A standard deviation: 1.7 minutes. Route B standard deviation: 8 minutes.

Sample responses:

- Route A is better, because the travel time is more predictable (the standard deviation is smaller).
- Route B is better, because two of the times are faster than any time on Route A. She might get to school in 12 minutes.

Activity Synthesis

Select students to share the route they chose, including their reasons. The purpose of the discussion is to relate standard deviation to variability and discuss how that is related to consistency in many situations.

If no one mentions it, point out that the mean travel time is 24 minutes for both routes, so the recommendation should be made on the basis of variability.

